L Number	Hits	Search Text	DB	Time stamp
-	1	electron near3 beam near3 gun same crucible and (MBE or molecular adj beam adj epitax$3) and 117/$4.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/08 18:44
-	7	electron near3 beam near3 gun same crucible and 117/$4.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/08 18:47
-	10	electron near3 beam near3 gun same crucible and (MBE or molecular adj beam adj epitax$3)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/08 18:58
-	9	solid near4 silicon near4 source same temperature and 117/$4.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/09 09:39
-	88	effusion near3 cell same (MBE or molecular adj beam adj epitax$3) and 117/$4.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/09 09:40
-	13	effusion near3 cell same (MBE or molecular adj beam adj epitax$3) same crucible and 117/$4.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/09 10:00
-	3	effusion near3 cell same (MBE or molecular adj beam adj epitax$3) same temperature near2 rate and 117/$4.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/09 10:12
-	20	effusion near3 cell near4 temperature same (MBE or molecular adj beam adj epitax$3) and 117/$4.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/01/09 10:13
-	10	solid near5 source near10 (MBE or molecular near2 beam near2 epitax$4) same (silicon near2 carbide or sic)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/02 11:28
-	14	(MBE or molecular near2 beam near2 epitax$4) near10 (silicon near2 carbide or sic) same solid	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/02 11:28
-	19	solid near20 (MBE or molecular near2 beam near2 epitax$4) same (sic or silicon adj carbide)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/02 13:30
-	88	solid near20 (MBE or molecular near2 beam near2 epitax$4) and (sic or silicon adj carbide)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/02 13:31
-	6	((sic or silicon adj carbide) near10 (coat$4 or lin$4) near10 crucible) and (MBE or molecular near2 beam near2 epitax$4)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/02 14:22

L Number	Hits	Search Text	DB	Time stamp
3	16	MBE and (SiC or silicon adj carbide) near10 crucible	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/11 09:30
4	45	silicon near5 source same (silicon near4 carbide or sic) near20 crucible	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/11 09:34
9	6	((((silicon adj carbide or sic) near15 (crucible)) or ((silicon adj carbide or sic) near15 (cell))) near10 (lin$4 or coat$4)) and (MBE or molecul$3 near2 beam near2 epitax$4)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/11 09:40
11	32	((sic or silicon adj caribide) near5 (coat$4 or liner or lining) near10 graphite) and (MBE or molecul$3 near2 beam near2 epitax$4)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/11 09:41
13	16	((sic or silicon adj caribide) near5 (coat$4 or liner or lining) near10 graphite) near5 crucible	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/11 09:49
15	1	knudsen near5 cell near20 (sic or silicon adj carbide)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/11 09:52
17	30	cell near20 (sic or silicon adj carbide) and 117$4.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/11 09:57
19	24	((MBE or molecul$3 near2 beam near2 epitax$4) near10 (sic or silicon adj carbide)) and 117$5.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/11 11:47
21	81	clean$4 near10 substrate same (CO2 or carbon near4 dioxide or "co.sub.2") and dry$4 same (N2 or "n.sub.2" or nitrogen)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/11 11:50
22	41	clean$4 near10 substrate near20 (CO2 or carbon near4 dioxide or "co.sub.2") and dry$4 same (N2 or "n.sub.2" or nitrogen)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/11 13:33
23	38	clean$4 near10 substrate near20 (CO2 or carbon near4 dioxide or "co.sub.2") near10 (pressur$4 or jet)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/11 13:15
24	32	clean$4 near10 substrate same (CO2 or carbon near4 dioxide or "co.sub.2") and (CMP or mechanical near5 (polish$4 or planar$4 or planariz$4))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/11 13:24
26	66	substrate near20 (CO2 or carbon near4 dioxide or "co.sub.2") same polish$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/11 13:32
30	49	((CMP or mechanical near4 (polish$4 or planar$4 or planariz$4))) same (dry$4 near20 (N2 or "n.sub.2" or nitrogen))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/11 13:34

31	12	((CMP or mechanical near4 (polish$4 or planar$4 or planariz$4))) and (dry$4 near20 (N2 or "n.sub.2" or nitrogen)) and (sic or silicon near3 carbide) near4 (substrate or wafer)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/11 13:42
33	1	dry$4 near20 (N2 or "n.sub.2" or nitrogen) near10 rins$4 same substrate same CMP	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/11 14:20
35	5	dry$4 near20 (N2 or "n.sub.2" or nitrogen) near10 rins$4 same substrate and (polish$4 or CMP) and (Sic or silicon adj carbide) near4 (film or grow$4 or deposit$4 or epitax$4)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/11 14:29
36	9	dry$4 near20 (N2 or "n.sub.2" or nitrogen) near10 rins$4 and (polish$4 or CMP) and (Sic or silicon adj carbide) near4 (film or grow$4 or deposit$4 or epitax$4)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/11 14:30
47	34	polish$4 same rins$4 same (nitrogen or n2 or "n.sub.2") same prepar$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/11 15:40

AB The elec. properties of the n-3C-**SiC**/p-Si heterojunction grown by **solid source mol. beam epitaxy** on carbonized in hydrogen rich and poor atmospheres leading to silicon and carbon face **silicon carbide** are investigated. It was found that elec. properties of the heterojunction formed in hydrogen poor atm. showed the better elec. performance. If germanium is added into the interface the elec. properties of the heterojunction formed under hydrogen rich conditions can be improved.

L5 ANSWER 2 OF 41 CAPLUS COPYRIGHT 2003 ACS
AB The elec. properties of the n-3C-**SiC**/p-Si heterojunction grown by **solid source mol.-beam epitaxy** on germanium-modified Si(111) substrates have been investigated. The current flow in the forward direction is detd. by diffusion and recombination currents. The interface state d. was detd. to be not larger than 1011 cm-2. The obtained interface state d. is lower than in the case of 3C-**SiC** grown on Si(111) by CVD deposition. Ge predeposition on silicon prior to **silicon carbide** is able to improve the ideality factor of the diode and decreases currents of the reverse biased n-3C-**SiC**/p-Si heterojunction diode.

L5 ANSWER 3 OF 41 CAPLUS COPYRIGHT 2003 ACS
AB Multi-quantum well structures with 3C-SiC wells between .alpha.-SiC barriers were grown in a two-step procedure by solid-source MBE. First, 1-dimensional wire-like 3C-SiC was nucleated selectively on terraces of the well-prepd. off-axis .alpha.-SiC(0001) substrates at low temp. (T<1500 K). Next, 3C-SiC lamellae were incorporated into the hexagonal layer material via simultaneous step-flow growth mode of both the 3C-SiC nuclei and the hexagonal substrate material at higher T and Si-rich conditions. In comparison to homopolytypic SiC layers, photoluminescence studies revealed addnl. signals, which can be explained by optical transitions within the thin cubic well layers.

L5 ANSWER 4 OF 41 CAPLUS COPYRIGHT 2003 ACS
AB High quality homoepitaxial 6H-SiC films were grown by solid-source MBE using C60 and Si effusion cells. Scanning electron micrographs show terraced surfaces indicative of step-flow growth. Cross-sectional TEM results demonstrate extremely good epitaxial growth with no hint of dislocations, double-positioning boundaries, or 3C inclusions. It is believed that this is the 1st report of homoepitaxy of 6H-SiC using C60 and the 1st instance of SiC epitaxy using a Si effusion cell in the evapn. rather than the sublimation mode. This combination of solid-source MBE and detn. of appropriate growth conditions led to superior homoepitaxial growth of 6H-SiC.

L5 ANSWER 5 OF 41 CAPLUS COPYRIGHT 2003 ACS
AB **Silicon carbide** layers were grown by **solid source mol.-beam epitaxy** on silicon (111). Prior to the **silicon carbide** growth, different amts. of germanium were predeposited on the silicon surface. Structural and morphol. investigations with RHEED, x-ray diffraction, at. force microscopy, and spectroscopic ellipsometry revealed an improvement of the surface and interface properties for Ge coverages around and below 1 ML. The improved structural properties of the heterojunction lead to an amendment of the forward and reverse properties of the **SiC**/Si heterojunction.

L5 ANSWER 6 OF 41 CAPLUS COPYRIGHT 2003 ACS
AB The growth of **SiC** layers on hexagonal (or .alpha.-) **SiC** (0001) was performed by **solid-source mol.. beam epitaxy** (MBE) between 1300 and 1600 K and The .alpha.-**SiC** layers were grown homoepitaxial via step-flow on off-axis substrates, whereas pseudomorphic cubic (or 3C-) **SiC** layers were obtained on .alpha.-**SiC** via nucleation and

subsequent step-flow. Under more equil.-like conditions, 3C-layers nearly free of twin-boundaries were obtained. The **SiC** layers were of high quality and without unintentional doping, as revealed by photoluminescence studies; The controlled growth of **SiC** heteropolytypic structures consisting of hexagonal and cubic polytypes, such as 4H/3C/4H-**SiC**(0 0 0 1) and 6H/3C/6H-**SiC**(0 0 0 1), also was demonstrated. Such structures were obtained by changing the growth conditions from lower temps. (1550 K) and Si-rich Si/C ratio (3C-**SiC**) to higher temps. (1600 K) and more C-rich Si/C ratio. On off-axis substrates, such heterostructures were also obtained by 1st nucleating selectively wire-like 3C-**SiC** nuclei on the terraces of well-prepd. .alpha.-**SiC**(0 0 0 1) substrates at low T (<1500 K) and a subsequent step-flow of both the 3C wires and the surrounding .alpha.-**SiC** material.

L5 ANSWER 7 OF 41 CAPLUS COPYRIGHT 2003 ACS

AB The silicon (111) surface was converted into **silicon carbide** by using: 1. propane dild. in hydrogen and rapid thermal processing, 2. elemental carbon deposited onto the silicon surface by **solid source mol. beam epitaxy** and subsequent annealing, i.e. conversion in a hydrogen poor environment, 3. modification of the silicon surface by Ge predeposition prior to elemental carbon deposition. These methods were compared according to their influence on the structure, morphol. and electronic properties of the **SiC**/Si(111) heteroepitaxial system. It was found that the conversion in a hydrogen rich environment leads to the formation of a carbon (111) **silicon carbide** face, whereas a silicon (111) **silicon carbide** face was formed under hydrogen poor conditions. Germanium predeposition led to an improvement of the structural morphol. and elec. properties of the **silicon carbide**-silicon heteroepitaxial system.

L5 ANSWER 8 OF 41 CAPLUS COPYRIGHT 2003 ACS

AB Undoped and B-doped SiC layers are grown on hexagonal SiC(0001) substrates by solid-source MBE. Hexagonal 4H- and 6H-SiC layers are grown homoepitaxially via step-controlled epitaxy, whereas the cubic 3C-SiC is grown pseudomorphically via nucleation and subsequent step flow. The low-temp. photoluminescence spectra only show the known emission lines of the so-called D1 center. The line positions are compared with results of 1st-principles calcns. The growth conditions, the line shape, and the line shift with the polytype support an interpretation as bound-exciton recombination at a native-defect complex that contains a Si vacancy.

L5 ANSWER 9 OF 41 CAPLUS COPYRIGHT 2003 ACS

AB The shape of interfacial voids formed in the epitaxial **SiC** /Si(111) heterosystem just underneath the **SiC** film was investigated using optical microscopy and transmission electron microscopy (TEM). **SiC** films are grown on Si(111) substrates at 2 different substrate temps. (specimen type 1 at 850.degree., specimen type 2 at 1050.degree.) using **solid-source mol.-beam epitaxy** (MBE). At 850.degree. substrate temp., the well-known triangular void shape with primary {111} facets is formed in the Si substrate, confirming the results already reported by Learn and Khan (1970). When grown at 1050.degree. substrate temp., a new void shape showing a hexagonal appearance in the plan-view direction is found. By indexing the hexagonal void planes, other facets with higher surface energies than the usual {111} type facets were obsd., leading to a void shape near the equil. void shape in a cubic crystal. As in the case of the triangular shaped voids, the formation process of the hexagonal shaped voids should start from the {111} planes, however, due to the higher substrate temp., planes with higher surface energies are formed in addn.

L5 ANSWER 10 OF 41 CAPLUS COPYRIGHT 2003 ACS

AB SiC layers were grown on hexagonal (or .alpha.-)SiC(0001) by solid-source

MBE. The layers were studied by photoluminescence at 4.2 K. The dominant emission lines in the spectra for all polytypes were attributed to the recombination of bound excitons at a D1-center. The intensity of the center lines increases for layers of higher perfection and doped by B, resp. No influence was found regarding a change of the chem. potential from more C-rich to Si-rich conditions. A shift of 2 meV to lower energies of the D1-center lines connected with a decrease in intensity was detected for 3C-SiC layers of high twin-boundaries d. The obtained results support the earlier interpretation of the nature of the D1-center to be result from a C-divacancy. The spectrum of intentionally B-doped samples exhibits the characteristic signature of the shallow B-related neutral four particle bound exciton complex.

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=> d 6 bib
L8 HAS NO ANSWERS
L1          97790 SEA FILE=CAPLUS ABB=ON  PLU=ON  SILICON (W) CARBIDE OR SIC
L2           2039 SEA FILE=CAPLUS ABB=ON  PLU=ON  SOLID (1W) SOURCE
L3          23886 SEA FILE=CAPLUS ABB=ON  PLU=ON  MOLECULAR (1W) BEAM (1W)
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L5   ANSWER 6 OF 41  CAPLUS  COPYRIGHT 2003 ACS
AN   2001:484897  CAPLUS
DN   135:219156
TI   High-quality SiC epitaxial layers and low-dimensional heteropolytypic SiC
     structures grown by solid-source MBE
AU   Fissel, A.
CS   Institut fur Festkorperphysik, Friedrich-Schiller-Universitat Jena, Jena,
     D-07743, Germany
SO   Journal of Crystal Growth (2001), 227-228, 805-810
     CODEN: JCRGAE; ISSN: 0022-0248
PB   Elsevier Science B.V.
DT   Journal
LA   English
RE.CNT  14     THERE ARE 14 CITED REFERENCES AVAILABLE FOR THIS RECORD
               ALL CITATIONS AVAILABLE IN THE RE FORMAT


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E1           1      FISSCHER LEO GEORGE MARIA/IN
E2           3      FISSEKIS JOHN D/IN
E3           0 --> FISSEL A/IN
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E25          5     FISTNER DAVID C/IN

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L10          1 ("FISSEL ANDREAS"/IN)

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L10 ANSWER 1 OF 1 CAPLUS COPYRIGHT 2003 ACS
AN 2002:391282 CAPLUS
DN 136:378531
TI Design and fabrication of a silicon carbide field effect transistor
IN Richter, Wolfgang; **Fissel, Andreas**; Bechstedt, Friedhelm
PA Friedrich-Schiller-Universitaet Jena Buero fuer Forschungstransfer, Germany
SO Ger. Offen., 6 pp.
CODEN: GWXXBX
DT Patent
LA German
FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	DE 10057739	A1	20020523	DE 2000-10057739	20001117
PRAI	DE 2000-10057739		20001117		

=> d l5 11-20 abs

L5 ANSWER 11 OF 41 CAPLUS COPYRIGHT 2003 ACS
AB The influence of Ge on the initial growth of **SiC** by low temp. **solid-source mol.-beam epitaxy** (SSMBE) on (111) and (100)Si was investigated by RHEED. On both orientations Ge is passivating partially the surface, reducing the growth rate and increasing the grain size. However, according to the results by Auger electron spectroscopy (AES) Ge is not floating on the surface during proceeding carbonization.

L5 ANSWER 12 OF 41 CAPLUS COPYRIGHT 2003 ACS
AB Using in situ RHEED, ex situ at. force microscopy (AFM) and transmission electron microscopy (TEM) the early stages of **SiC** growth on Si during the carbonization were investigated in a **solid source mol. beam epitaxy** equipment. Different mechanisms of **SiC** ppt. growth by SSMBE were found. The **SiC** growth during carbonization of Si(111) at 600.degree.C is controlled by diffusion and at higher temps. by a two-dimensional nucleation process, which is mononuclear at 660.degree.C and polynuclear above 750.degree.C. At temps. greater than 750.degree.C and 850.degree.C three-dimensional nucleation occurs at (111) and (100) surfaces, resp.

L5 ANSWER 13 OF 41 CAPLUS COPYRIGHT 2003 ACS
AB The controlled growth of SiC heteropolytypic structures consisting of hexagonal and cubic polytypes was performed by solid-source MBE. On on-axis substrates, 4H/3C/4H-SiC(0001) and 6H/3C/6H-SiC(0001) structures were obtained by 1st growing the 3C-SiC layer some nanometer thick at lower substrate temps. (T = 1550 K) and Si-rich conditions and a subsequent growth of .alpha.-SiC on top of the 3C-SiC layer at higher T

(1600 K) under more C-rich conditions. On off-axis substrates, multiheterostructures consisting of 4H/3C- or 6H/3C-stacking sequences were also obtained by 1st nucleating selectively 1-dimensional wire-like 3C-SiC on the terraces of well-prepd. off-axis .alpha.-SiC(0001) substrates at low T(<1500 K). Next, SiC was grown further in a step-flow growth mode at higher T and Si-rich conditions. After the growth, many wire-like regions consisting of 3C-SiC were found also within the hexagonal layer material matrix indicating a simultaneous step-flow growth of both the cubic and the hexagonal SiC material.

L5 ANSWER 14 OF 41 CAPLUS COPYRIGHT 2003 ACS
AB Transmission electron microscopy (TEM) images of 3C-**SiC** thin films on Si (111) grown by **solid-source mol. beam epitaxy** (MBE) often reveal interfacial voids just underneath the film because of the Si out-diffusion from the substrate into the layer. The same phenomenon can be seen in the 2H-AlN thin film/Si (111) heterosystem grown by plasma-assisted MBE. We demonstrate in both cases the influence of growth parameters on the created voids. In the **SiC**/Si system we show an important influence of the growth temp. At 850.degree.C a well-known triangular void is formed, whereas at 1050.degree.C we found an unusual hexagonal void shape. In this case not only low surface energy {111} facets form the void shape, but also facets with higher surface energy. We discuss this new appearance as a void shape which is near the equil. void shape in a cubic crystal. In the AlN/Si heterosystem the initial covering of the substrate has an influence on the amt. of the Si outdiffusion and therefore on the size of the voids. In samples with an initial nitrogen cover the Si content in the AlN layer is higher (.apprx.1021 cm-3) and the voids are more larger compared to samples with an initial Al cover (Si content .apprx.1018 cm-3).

L5 ANSWER 15 OF 41 CAPLUS COPYRIGHT 2003 ACS
AB 3C-**SiC** was grown on (111)Si by **solid source mol. beam epitaxy**. The use of Ge during the carbonization leads to an improvement of the crystal quality of the grown layers. Electron spectroscopy revealed that Ge is incorporated mainly into the heterointerface. The obsd. effects are discussed in relation to different theories.

L5 ANSWER 16 OF 41 CAPLUS COPYRIGHT 2003 ACS
AB 3C-**SiC** was grown by carbonization on (111)Si by **solid source mol. beam epitaxy** at 750.degree.C. The use of addnl. Ge deposition before or during carbonization leads to a lowering of the **SiC** growth rate in a different way at the beginning of the growth process, which was obtained by real time spectroscopic ellipsometry and real time RHEED. Ge is mainly incorporated at the **SiC**/Si interface and causes an increase of the **SiC** grain diam. independent on the incorporation method.

L5 ANSWER 17 OF 41 CAPLUS COPYRIGHT 2003 ACS
AB Epitaxial growth expts. to realize SiC heteropolytypic structures were performed in two different ways by solid-source MBE depending on substrate orientation. In the 1st way, on on-axis substrates, 4H/3C/4H-SiC(0001) structures were grown by 1st nucleating a few monolayers thick 3C-SiC layer at lower temps. (T < 1500 K). In a 2nd step, 4H-SiC was grown on top of the 3C-SiC layer under C-rich conditions and low supersaturations at higher T (1600 K). 3C-SiC layers grown on well-prepd. surfaces at low super-saturations are free of double-position boundaries in a large scale (some mm2). The 3C-SiC layers grow pseudomorphic with respect to the substrate for both 6H- and 4H-SiC. Also, a 2nd way is opened to grow multi-heterostructures consisting of 4H/3C- or 6H/3C -stacking sequences by 1st nucleating 3C-SiC selectively on the terraces of well-prepd. off-axis .alpha.-SiC(0001) substrates at low T (< 1300 K). Next, the SiC layers were grown further in a step-flow growth mode at high T and conditions corresponding to a low supersatn. (Si-rich). In this way also

smaller (1-dimensional-wires) structures were obtained on the terraces of the hexagonal material in the initial stage of growth. The no. of these wires is strongly dependent on the substrate temp. and the off-angle. As revealed by electron channeling, Raman and photoluminescence spectroscopy, many wire-like regions consisting of 3C-SiC were found within the hexagonal SiC layer material after the subsequent layer growth on the C-face of .alpha.-SiC(0001), indicating a simultaneous step-flow growth of the cubic and hexagonal material.

L5 ANSWER 18 OF 41 CAPLUS COPYRIGHT 2003 ACS
AB The growth of certain **SiC** polytypes in the **solid-source mol. beam epitaxial** growth (MBE) process was analyzed within the framework of classical thermodn. nucleation theory. The formation of certain polytypes in the nucleation stage is due to a complex interplay between their differences in the surface and formation energy as well as the growth conditions. Based on these considerations, the growth conditions were estd. quant. which show a preference for certain polytype on the **SiC**(0001) Si-face. The estns. clearly indicate that the formation of a polytype in the nucleation stage is detd. by a set of growth parameters: substrate temp., Si/C-ratio and C-flux. The nucleation of the cubic 3C-**SiC** polytype is preferred generally under conditions of high supersatn. or large Si/C-ratio, while the formation of 4H-**SiC** is more favored at low supersaturations and more C-rich conditions. 6H-**SiC** or 15 R-**SiC** should occur under conditions in between them. Considering a stronger relaxation of the C-face in comparison to the Si-face, the formation of 4H-**SiC** is clearly preferred on the (0001) C-face in a wider range of growth conditions, while the probability of 3C-**SiC** nucleation is much lower than on the Si-face. Also, an increase in temp. also increases the nucleation probability of the hexagonal polytypes. The obtained results agree very well with exptl. findings based on **SiC**-bulk sublimation growth expts. as well as with results recently obtained by MBE.

L5 ANSWER 19 OF 41 CAPLUS COPYRIGHT 2003 ACS
AB 3C-SiC/Si structures with Ge incorporation are elaborated by solid source MBE (SSMBE). A comparison of the flatness of the SiC-surface and the interface between SiC and Si by comparing the deposition with and without Ge is made. The results are analyzed within the framework of a theor. approach based on the theory of elasticity.

L5 ANSWER 20 OF 41 CAPLUS COPYRIGHT 2003 ACS
AB The influence of the heating rate on the initial growth of **SiC** on silicon by carbonization was investigated for two strongly differing methods: **solid source mol. beam epitaxy** and rapid thermal chem. vapor deposition. An improvement of the structural and morphol. properties can be obtained by a two-dimensional nucleation stimulated by a defined heating cycle in a (hydro-)carbon flux. This improvement is strongly assocd. with a decreased diffusion coeff. for silicon through the grown layer.

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        319697 SUBSTRATES
        853625 SUBSTRATE
                 (SUBSTRATE OR SUBSTRATES)
       3130679 TEMP?
L11      38857 SUBSTRATE (5W) TEMP?

=> s l11 and l5
L12         15 L11 AND L5

=> s l12 1-10 abs
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MISSING OPERATOR L12 1-10
The search profile that was entered contains terms or
nested terms that are not separated by a logical operator.

=> d l12 1-10 abs

L12 ANSWER 1 OF 15 CAPLUS COPYRIGHT 2003 ACS
AB Multi-quantum well structures with 3C-SiC wells between .alpha.-SiC barriers were grown in a two-step procedure by solid-source MBE. First, 1-dimensional wire-like 3C-SiC was nucleated selectively on terraces of the well-prepd. off-axis .alpha.-SiC(0001) **substrates** at low **temp**. (T<1500 K). Next, 3C-SiC lamellae were incorporated into the hexagonal layer material via simultaneous step-flow growth mode of both the 3C-SiC nuclei and the hexagonal substrate material at higher T and Si-rich conditions. In comparison to homopolytypic SiC layers, photoluminescence studies revealed addnl. signals, which can be explained by optical transitions within the thin cubic well layers.

L12 ANSWER 2 OF 15 CAPLUS COPYRIGHT 2003 ACS
AB The shape of interfacial voids formed in the epitaxial **SiC** /Si(111) heterosystem just underneath the **SiC** film was investigated using optical microscopy and transmission electron microscopy (TEM). **SiC** films are grown on Si(111) **substrates** at 2 different **substrate temps**. (specimen type 1 at 850.degree., specimen type 2 at 1050.degree.) using **solid-source mol.-beam epitaxy** (MBE). At 850.degree. **substrate temp**., the well-known triangular void shape with primary {111} facets is formed in the Si substrate, confirming the results already reported by Learn and Khan (1970). When grown at 1050.degree. **substrate temp**., a new void shape showing a hexagonal appearance in the plan-view direction is found. By indexing the hexagonal void planes, other facets with higher surface energies than the usual {111} type facets were obsd., leading to a void shape near the equil. void shape in a cubic crystal. As in the case of the triangular shaped voids, the formation process of the hexagonal shaped voids should start from the {111} planes, however, due to the higher **substrate temp**., planes with higher surface energies are formed in addn.

L12 ANSWER 3 OF 15 CAPLUS COPYRIGHT 2003 ACS
AB The controlled growth of SiC heteropolytypic structures consisting of hexagonal and cubic polytypes was performed by solid-source MBE. On on-axis substrates, 4H/3C/4H-SiC(0001) and 6H/3C/6H-SiC(0001) structures were obtained by 1st growing the 3C-SiC layer some nanometer thick at lower **substrate temps**. (T = 1550 K) and Si-rich conditions and a subsequent growth of .alpha.-SiC on top of the 3C-SiC layer at higher T (1600 K) under more C-rich conditions. On off-axis substrates, multiheterostructures consisting of 4H/3C- or 6H/3C-stacking sequences were also obtained by 1st nucleating selectively 1-dimensional wire-like 3C-SiC on the terraces of well-prepd. off-axis .alpha.-SiC(0001) substrates at low T(<1500 K). Next, SiC was grown further in a step-flow growth mode at higher T and Si-rich conditions. After the growth, many wire-like regions consisting of 3C-SiC were found also within the hexagonal layer material matrix indicating a simultaneous step-flow growth of both the cubic and the hexagonal SiC material.

L12 ANSWER 4 OF 15 CAPLUS COPYRIGHT 2003 ACS
AB Epitaxial growth expts. to realize SiC heteropolytypic structures were performed in two different ways by solid-source MBE depending on substrate orientation. In the 1st way, on on-axis substrates, 4H/3C/4H-SiC(0001) structures were grown by 1st nucleating a few monolayers thick 3C-SiC layer at lower temps. (T < 1500 K). In a 2nd step, 4H-SiC was grown on top of the 3C-SiC layer under C-rich conditions and low supersaturations at higher T (1600 K). 3C-SiC layers grown on well-prepd. surfaces at low

super-saturations are free of double-position boundaries in a large scale (some mm2). The 3C-SiC layers grow pseudomorphic with respect to the substrate for both 6H- and 4H-SiC. Also, a 2nd way is opened to grow multi-heterostructures consisting of 4H/3C- or 6H/3C -stacking sequences by 1st nucleating 3C-SiC selectively on the terraces of well-prepd. off-axis .alpha.-SiC(0001) substrates at low T (< 1300 K). Next, the SiC layers were grown further in a step-flow growth mode at high T and conditions corresponding to a low supersatn. (Si-rich). In this way also smaller (1-dimensional-wires) structures were obtained on the terraces of the hexagonal material in the initial stage of growth. The no. of these wires is strongly dependent on the **substrate temp**. and the off-angle. As revealed by electron channeling, Raman and photoluminescence spectroscopy, many wire-like regions consisting of 3C-SiC were found within the hexagonal SiC layer material after the subsequent layer growth on the C-face of .alpha.-SiC(0001), indicating a simultaneous step-flow growth of the cubic and hexagonal material.

L12 ANSWER 5 OF 15 CAPLUS COPYRIGHT 2003 ACS

AB The growth of certain **SiC** polytypes in the **solid-source mol. beam epitaxial** growth (MBE) process was analyzed within the framework of classical thermodn. nucleation theory. The formation of certain polytypes in the nucleation stage is due to a complex interplay between their differences in the surface and formation energy as well as the growth conditions. Based on these considerations, the growth conditions were estd. quant. which show a preference for certain polytype on the **SiC**(0001) Si-face. The estns. clearly indicate that the formation of a polytype in the nucleation stage is detd. by a set of growth parameters: **substrate temp.**, Si/C-ratio and C-flux. The nucleation of the cubic 3C-**SiC** polytype is preferred generally under conditions of high supersatn. or large Si/C-ratio, while the formation of 4H-**SiC** is more favored at low supersaturations and more C-rich conditions. 6H-**SiC** or 15 R-**SiC** should occur under conditions in between them. Considering a stronger relaxation of the C-face in comparison to the Si-face, the formation of 4H-**SiC** is clearly preferred on the (0001) C-face in a wider range of growth conditions, while the probability of 3C-**SiC** nucleation is much lower than on the Si-face. Also, an increase in temp. also increases the nucleation probability of the hexagonal polytypes. The obtained results agree very well with exptl. findings based on **SiC**-bulk sublimation growth expts. as well as with results recently obtained by MBE.

L12 ANSWER 6 OF 15 CAPLUS COPYRIGHT 2003 ACS

AB The solid source MBE is known to allow the lowest process temps. to grow SiC on Si. The nucleation and the initial SiC growth were studied, a growth model in dependence on the supersatn. is proposed. At high supersatn., smooth continuous layers with large voids in the **substrate** and esp. at low **temps**. noncubic inclusions are formed. At low supersaturations, large islands which are sepd. by deep trenches were formed. Both cases allow an unlimited Si transport to the surface. In an intermediate range, both types of defects can be reduced.

L12 ANSWER 7 OF 15 CAPLUS COPYRIGHT 2003 ACS

AB The relationship between the defect microstructure of **SiC** films grown by **solid-source mol.-beam epitaxy** on 4H and 6H-**SiC** substrates and their growth conditions, for **substrate temps**. ranging between 950 and 1300.degree.C, has been investigated by a combination of transmission electron microscopy and at. force microscopy. The results demonstrate that the formation of defective cubic films is generally found to occur at temps. below 1000.degree.C. At temps. above 1000.degree.C our investigations prove that simultaneous supply of C and Si in the step-flow growth mode on vicinal 4H and 6H substrate surfaces results in defect-free hexagonal **SiC** layers, and defect-free cubic **SiC** can be

grown by the alternating deposition technique. The controlled overgrowth of hexagonal on top of cubic layers is demonstrated for thin layer thicknesses.

L12 ANSWER 8 OF 15 CAPLUS COPYRIGHT 2003 ACS
AB The effects of different growth parameters on the microstructure of the SiC films formed during simultaneous two-source mol.-beam-epitaxial (MBE) deposition were studied. **Substrate temps**. as low as 750-900.degree. were used. The relation between a no. of different growth morphologies and deposition conditions was established. The formation of single-crystal 3C films occurs at low growth rates but within a limited Si:C adatom ratio. A combination of TEM and at. force microscopy (AFM) was used to examine the different films.

L12 ANSWER 9 OF 15 CAPLUS COPYRIGHT 2003 ACS
AB Thin epitaxial films of cubic SiC were grown on Si(111) substrates by solid-source MBE at a **substrate temp**. of 1000.degree. and a growth rate of 1 nm/min. An improved SiC growth was achieved by prepg. a clean (7.times.7)-Si(111) substrate surface, carbonization of this surface at a low temp. (650.degree.), followed by a short annealing step and the deposition of SiC with a step decrease in supersatn. The films were characterized by RHEED, LEED, TEM, XRD, electron channeling, and Raman and IR spectroscopy. They showed good crystallinity with a low twin d. and a significant redn. of interface-related defects already at low film thicknesses (300 nm).

L12 ANSWER 10 OF 15 CAPLUS COPYRIGHT 2003 ACS
AB The deposition of SiC layers on (111)Si substrates by simultaneous evapn. of Si and C in a MBE chamber at **substrate temps**. between 750-1100.degree. was studied. The structural and morphol. evolution of the layers were investigated in dependence of the treatment of the **substrate** (carbonized or not), the **substrate temp**., and the Si/C ratio using AFM, XRD, Auger electron depth profiling, and in situ and ex situ RHEED. Two different polytypes of (3C-SiC and 2H-SiC) were deposited on Si(111) under the MBE conditions. The grain structure of the films was typical for low-temp. growth of SiC on Si and and did not depend on the growth method applied.

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L12 ANSWER 11 OF 15 CAPLUS COPYRIGHT 2003 ACS
AB The carbonization of Si(111) surfaces exposed to a sublimed carbon mol. beam with carbon fluxes varying about two orders of magnitude at **substrate temps**. 700-1050.degree. was studied. The structural and morphol. evolution was investigated in comparison to the growth under rapid thermal chem. vapor deposition (RTCVD) conditions. Two different polytype structures, 3C- and 2H-SiC, were grown on 4 in. Si(111) wafers. In the investigated parameter range, the carbonized layers formed by RTCVD have a better crystallinity and a smoother surface.

L12 ANSWER 12 OF 15 CAPLUS COPYRIGHT 2003 ACS
AB The structural and photoluminescence (PL) properties of several types of pseudomorphic Si1-x-yGexCy quantum well (QW) structures grown by **solid-source mol. beam epitaxy** on (001) Si substrates are described. Optimum Si1-yCy growth takes place at a **substrate temp**. of about 550.degree.C and a growth rate .ltoreq.1.ANG./s. Well-defined alloy layers with no defects or **SiC** ppts. are obsd. by transmission electron microscopy (TEM). Excitonic band edge related PL is emitted from Si1-yCy/Si multiple QWs (MWQ). The band gap of strained Si1-yCy is drastically reduced by about .DELTA.E = -y.times.6.5eV. Reducing the width of Si0.99C0.01 layers results in a PL blueshift up to 45meV which is attributed to the strong (weak) quantum well confinement of .DELTA.(2)

valley electron (light hole) states. The band alignment in Si1-yCy/Si QWs is basically explained by the strain-induced shift of levels due to C incorporation. In Si1-x-yGexCy QWs, compressive strain caused by Ge is partially compensated by C and the band gap increases by .DELTA.E = y.times.2.4eV. Si1-yCy as well as Si1-x-yGexCy QWs give rise to spatially direct PL transitions. Closely spaced Si1-yCy/Si1-xGex double quantum wells (DQW) give rise to spatially indirect PL recombination of .DELTA.(2) electrons confined in the Si1-yCy layers and heavy holes localized in the Si1-xGex layers. The no-phonon transitions and the integrated PL intensity from thin DQWs are strongly enhanced compared to SQWs. In Hall transport studies, Si1-yCy and SiGeC alloys on Si reveal electron and hole mobilities which are well comparable to Si and SiGe or even improved. C alloying provides a significant extension of the possibilities in band structure engineering of Group-IV semiconductors.

L12 ANSWER 13 OF 15 CAPLUS COPYRIGHT 2003 ACS

AB Thin cryst. SiC films were grown on Si(111) using solid state evapn. at **substrate temps**. between 780 and 900.degree.. The growth rates were at 30-120 nm h-1. The films were characterized by in situ RHEED and ex situ TEM, SEM, IR spectroscopy and XRD. The films grown at high temps. and low growth rates are epitaxial. They mostly consist of twinned-cubic structure, but with increasing layer thickness hexagonal stacking sequences often were found. In the orientation distribution function full width at half max. (FWHM) values of down to 1.degree. were measured.

L12 ANSWER 14 OF 15 CAPLUS COPYRIGHT 2003 ACS

AB Epitaxial growth of stoichiometric Sic on Si(111) and 2.degree.-5.degree. off-oriented 6H-SiC(0001) **substrates** was carried out at low **temps**. (800-1000.degree.) by solid-source MBE controlled by a quadrupole mass spectrometry based flux meter. The films were obtained on Si-stabilized surfaces showing (3.times.3) and (2.times.2) superstructures in the case of SiC(0001). The reflection high-energy diffraction (RHEED) patterns and damped RHEED-oscillations during the growth on 6H-SiC(0001) at T > 900.degree. indicate that two-dimensional nucleation on terraces is the dominant growth process.

L12 ANSWER 15 OF 15 CAPLUS COPYRIGHT 2003 ACS

AB Single-cryst. cubic SiC layers were grown on Si(111) substrates by MBE using graphite and Si solid sources at relatively low **substrate temps**. (800.degree.). The growth process employs initial carbonization of the (111) Si surface followed by direct deposition of both Si and C. RHEED, x-ray diffraction, cross-sectional and plan-view TEM, Auger electron spectroscopy (AES), and optical Nomarski microscopy were used to characterize the films. At. ratio of Si to C during the growth is crit. in terms of the cryst. quality as well as surface morphol. of the films. To the extent of the instrumental accuracy, AES shows the SiC films to be stoichiometric. X-ray diffraction and TEM measurements confirm the cryst. nature of the SiC films.

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TI Advances in the molecular-beam epitaxial growth of artificially layered heteropolytypic structures of SiC

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PB American Institute of Physics